# Miocene Suidae from Ad Dabtiyah, eastern Saudi Arabia

## M. Pickford

Department of Palaeontology, Johannes-Gutenberg-Universität, Postfach 3980, Saarstrasse 21, D-6500 Mainz, BRD

## Synopsis

Two of four suid teeth from Ad Dabtiyah, Saudi Arabia, are ascribed to *Listriodon*; the others are fragmentary. A Middle Miocene (Mein Zone 4a or 4b) age is suggested. The wider significance of the assemblage is discussed.

## Introduction

Four suid teeth from Ad Dabtiyah, Saudi Arabia, have been examined and assigned to two taxa, one of which is a reliable marker for the Middle Miocene period in Europe, India and Africa. The best preserved specimens, an $M^3$ and an $M_3$, belong to a bunodont, thick-enamelled listriodont similar to *Listriodon lockharti* (Pomel) from early Middle Miocene strata of Europe, and to *Listriodon akatikubas* Wilkinson from sites of similar age in Kenya. The remaining two specimens are fragmentary, one of them being an incompletely formed tooth germ. Both, however, are bunodont and recall the genera *Conohyus* Pilgrim and *Kenyasus* Pickford, but the material is too incomplete for the purposes of specific identification. A specimen from another collection from Saudi Arabia suggests affinities with *Kenyasus*, a relatively common genus in the Kisingiri sites of Rusinga, Karungu and Uyoma, dated about $17\cdot8 \pm 0\cdot2$ Ma (Drake *et al.*, in prep.).

Viewed as an assemblage, the four teeth would not be out of place in early Middle Miocene strata of East Africa and Europe, perhaps 16–17 Ma old. The listriodont teeth in particular appear to represent a period of evolution prior to *Listriodon splendens* von Meyer of Europe and *L. pentapotamiae* (Falconer) of late Middle Miocene strata of Pakistan. Correlation of the Ad Dabtiyah site with Mein Zone 4a or 4b, and Maboko (Kenya), is indicated. This leads us to postulate that the Ad Dabtiyah site preserves faunal elements which lived just after the closure of the Tethys at the beginning of the Langhian Stage, an event which not only provided 'dryshod' access for Eurasian faunas to Africa and *vice versa*, but also resulted in major global climatic changes recorded in western Kenya, the Tethys, and as far afield as Japan. Zoogeographic boundaries shifted latitude during this event, which resulted in the widespread establishment of African faunal elements in southern Eurasia and a marked influx of Eurasian faunal elements into Africa. *Listriodon* was one of these widespread genera, which makes it a useful biostratigraphic marker for this and immediately subsequent periods.

## Systematics

### Subfamily LISTRIODONTINAE Simpson, 1945

### Genus *LISTRIODON* Von Meyer, 1846

TYPE SPECIES. *Listriodon splendens* von Meyer, 1846

#### *Listriodon* cf. *lockharti* (Pomel, 1848)
#### Figs 49–50

MATERIAL. Right $M_3$ M.42949; right $M^3$ M.42950.

DESCRIPTION. M.42949 is a right $M_3$ lacking the anterior buccal cusp. The cusp morphology and simple talonid of this tooth indicate that it belongs to the genus *Listriodon*, although its

enamel is somewhat thicker and the cusps more bunodont than in *L. splendens* and *L. pentapo-tamiae*. The median accessory cusp is large but closely joined to the cross lophs which are well formed, but low. The 'furchen' or grooves are well marked considering the wear stage of the tooth and its listriodont affinities. The talonid is simple and strongly joined to the posterior loph *via* the posterior accessory cusp. There are cingular remnants in the ends of the buccal valleys. The overall morphology of this tooth resembles that seen in bunodont listriodonts from Europe and Africa.

The length and estimated breadth of M.42949 at the base of the crown are 32·8 and 19·5 mm respectively.

M.42950 is a right M$^3$ lacking only the roots and small fragments of enamel at the cervix level. Its enamel is thicker than is usually found in *L. splendens* and the tooth is more bunodont and lower-crowned, while the lophs are less well formed than in *L. pentapotamiae*. The 'furchen' are not clear, because they have apparently been eradicated by wear which has advanced to the stage where dentine is exposed on the two lingual cusps. The talon is simple and the lingual flare is marked.

The length and breadth of M.42950 are 25·9 and 22·0 mm respectively.

Discussion. These two teeth probably belong to the same taxon, a bunodont listriodont close to *Listriodon lockharti* (Pomel, 1848) or *L. akatikubas* Wilkinson 1976. Teeth like these have
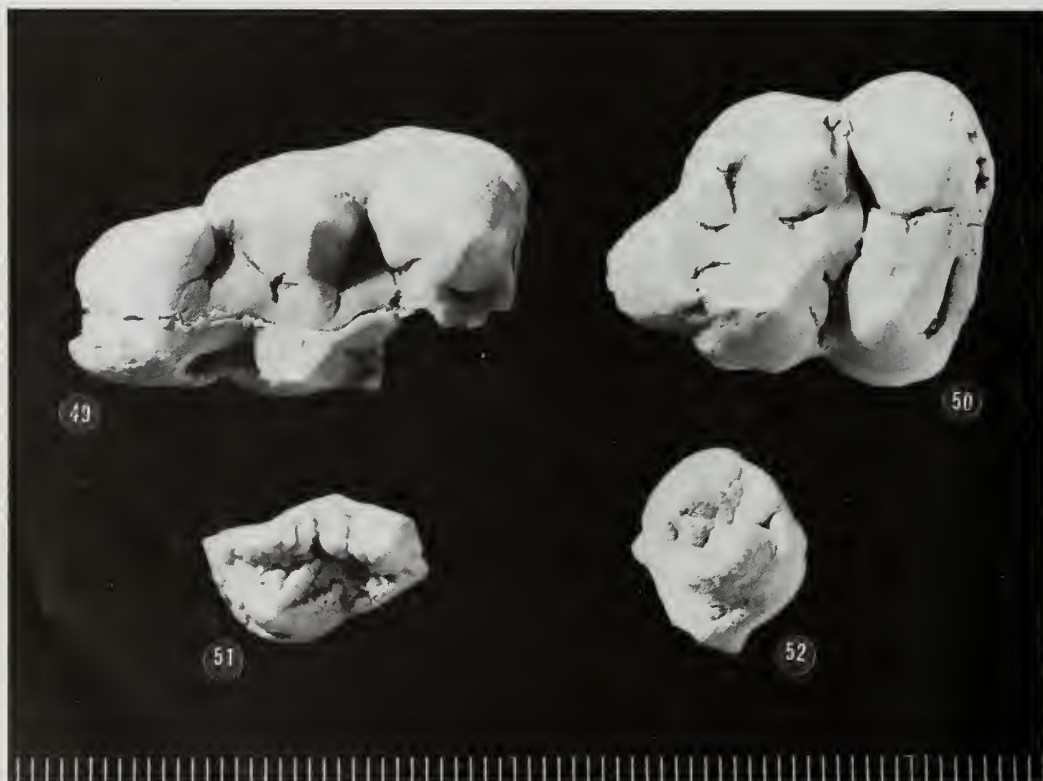


Figs 49–50   M.42949 and M.42950, respectively lower and upper third molars of a bunodont *Listrio-don*. Ad Dabtiyah, Saudi Arabia.
Fig. 51   M.42951, fragment of lower molar of a bunodont suid, possibly *Kenyasus*. Ad Dabtiyah, Saudi Arabia.
Fig. 52   M.42952, fragment of unerupted and incompletely formed lower molar of a bunodont suid. Ad Dabtiyah, Saudi Arabia.

never been reliably recorded from Lower Miocene sites in Kenya, despite the reports of Wilkinson (1976). Indeed, the subfamily Listriodontinae is unknown in Kenyan Lower Miocene deposits. The genus *Bunolistriodon* is a synonym of *Listriodon* (see Leinders 1975). In any case the material identified as *Bunolistriodon* by Arambourg (1963) and Wilkinson (1976) belongs to the subfamily Kubanochoerinae Gabunia, 1960 (Pickford 1985). The Ad Dabtiyah listriodont teeth do not resemble the species ?*L. akatidogus* Wilkinson, which is probably not a listriodont suid, but possibly a tayassuid (Pickford 1985). The only African species which resembles the Ad Dabtiyah sample is *Listriodon akatikubas*, which is known from Maboko, Nyakach, Kirimun and Fort Ternan, all Middle Miocene sites in Kenya.

From the European viewpoint, the Ad Dabtiyah listriodont teeth resemble those of *L. lockharti* known from a number of lower middle Miocene sites in southern Europe such as La Romieu (France), and from Pasalar (Turkey). The teeth are considerably more lophodont than the most lophodont Orleanian suids of southern Europe, such as *Palaeochoerus giganteus* described by Golpe-Posse (1972). The Saudi Arabian teeth are considerably more bunolophodont than teeth assigned to *L. splendens*, which is characteristic of late Vindobonian localities of Europe. As far as is known, the genus *Listriodon* has at most only minimal overlap in time with *Hipparion*, its stratigraphical range being nearly totally limited to the Middle Miocene.

From the Asian viewpoint the Saudi listriodonts compare with some of the teeth identified as *Listriodon guptai* from the Sind in Pakistan (Pilgrim 1926), although much of this material is more likely to represent *L. pentapotamiae*, a very lophodont form from Chinji levels in the Potwar Plateau. *Listriodon affinis* from Bugti is inadequately known, and the holotype may well represent a kubanochoere, (Pickford, in prep.). In any case it does not match the Saudi specimens. It therefore seems that in Asia *Listriodon* is confined to Middle Miocene deposits as it is in Africa and Europe.

Taking everything into consideration, I consider it likely that the Ad Dabtiyah listriodonts indicate an age close to Mein Zone MN 4a or 4b or perhaps a little later (Mein 1977, 1979, 1985). This would correspond to middle Orleanian deposits.

Subfamily ? **KUBANOCHOERINAE** Gabunia, 1958

**Genus indet.**
Figs 51–52

MATERIAL. M.42951, less than half the crown of a left lower molar; M.42952, distal half of an incompletely formed left lower molar.

DESCRIPTION. M.42951 is less than half of the crown of a left lower molar. The enamel is relatively thick, the cusps appear to be rounded and the 'furchen' are relatively shallow. There is a beaded cingular remnant in the buccal end of the median valley and the median accessory cusplet is small. These features suggest that we might be dealing with the genus *Kenyasus* Pickford (1985) or *Conohyus* Pilgrim. It is unlikely that the tooth belongs to *Hyotherium* von Meyer, although in view of the fragmentary nature of the specimen there must be room for doubt. The somewhat open labial notch is wider than is usually the case in *Conohyus*, which possibly tilts the balance in favour of this specimen representing a kubanochoerine such as *Kenyasus*.

M.42592 is the distal half of an incompletely formed lower molar. Considering that it was not fully formed at the time of death of the individual, it is difficult to make a valuable statement about this tooth. It may perhaps represent the same taxon as the previously described fragment.

DISCUSSION. I have seen a small kubanochoerine tooth in another collection from Saudi Arabia, which seems to be close in morphology to the Lower Miocene *Kenyasus rusingensis*. It is likely that this tooth and M.42591–2 described above belong to a single taxon. If these suppositions are correct, then it would follow that we are examining a suid which is usually Lower Miocene in age, although it extends up to lower Middle Miocene sites in Kenya such as Nachola.

In view of the fragmentary nature of these two specimens, I weigh the listriodont teeth as far more valuable from the point of view of biostratigraphy. Nevertheless, the presence of *Kenyasus* at Ad Dabtiyah, if it is eventually sustained, would not invalidate an age estimate of lower Middle Miocene, but would suggest that it was very early in that period. Kubanochoeres seem to have evolved in Africa, spreading into Eurasia during the Middle Miocene, where they have been recorded from Turkey, Georgia, China and India (Pickford 1985). It is possible that Ad Dabtiyah records the first of these emigrant kubanochoeres.

## Palaeozoogeography

Ad Dabtiyah has yielded only a small sample of suids, but they are exceptionally interesting from the point of view of zoogeography. Suids often seem to be in the vanguard of emigrations. Along with gomphotheres, they seem to comprise a sort of 'chef de file', appearing in new regions in advance of many other taxa. They are therefore generally good indicators for changes in environment or for the opening up of migration pathways.

At Ad Dabtiyah, it is possible that a crossing of the ways has been sampled, with the genus *Listriodon* making its way into Africa and the genus *Kenyasus* emigrating to southern Eurasia. I would be happier, however, if we had more definitive samples of the bunodont suid from the site before fully accepting this.

Although we need not postulate the existence of 'dryshod' access across the Tethys to account for the migration of suids and proboscideans, it would appear that the Tethys had indeed closed by the time the Ad Dabtiyah sediments accumulated (Adams *et al.* 1983, Whybrow 1984, Thomas 1985). Closure of the Tethys would surely have had marked effects on regional and perhaps global climates as a result of changes in circulation of the Atlantic and Indian Oceans. It was at about the time of the postulated closure that widespread 'heating' events occurred in the western Tethys (Anon. 1984), Japan (the Kurosedani event, Karyu *et al.* 1984) and western Kenya (Pickford & Senut, in prep.). In west Kenya the regional climate, as inferred from fossil terrestrial gastropods, was humid and hot during the Lower Miocene (at Koru, Songhor and Rusinga) but changed dramatically by the time the Maboko sediments accumulated. At Maboko, the gastropods suggest that the region was a semi-desert with gallery forests fringing the rivers. Somewhat later, at Fort Ternan, cooler, wetter conditions were re-established.

The Kurosedani event in Japan is characterized by the establishment of tropical to sub-tropical mangroves and associated mollusc assemblages in many parts of Japan, at least 1000 km north of their closest living occurrences. Sea temperatures in Japan rose by 10°C (summer temperatures) or 20°C (winter temperatures). This event has been dated between 15–16 Ma (Karyu *et al.* 1984).

It is tempting to ascribe these 'heating' events at the beginning of Langhian times, observed in three widely separated areas, to a single cause, occurring as they do at about the same time (as far as current datings indicate). If this is so, then a single major geological event such as closure of the Tethys might represent the fundamental root cause of such a global effect.

Confirmatory evidence is afforded by the faunas, which underwent marked changes in many parts of the Old World at about the same time. The faunas of western Kenya underwent a major turnover between Rusinga (Lower Miocene) and Maboko (Middle Miocene) (Pickford 1981). West European faunas underwent comparable changes, which have been utilized in defining the boundary between Lower and Middle Miocene faunas in that part of the world (Mein 1979). Although the Asian evidence is not so well dated, it seems that similar changes in fauna may have occurred at the beginning of the Middle Miocene.

For these widespread and apparently synchronous faunal changes to have occurred, it seems likely that tropical and sub-tropical zoogeographic conditions extended appreciably further north during the Middle Miocene than they did before. Even the suid evidence on its own supports this contention because at present, and at times during the past, suids have shown marked latitudinal stratification, with well-defined Palaearctic elements clearly distinguishable from their more southerly tropical counterparts (Pickford 1985, and in prep.). At Ad Dabtiyah

and penecontemporary sites we have what I consider reasonable evidence that the Ethiopian zoogeographic realm had spread northwards at the expense of the Palaearctic realm, and that it incorporated Saudi Arabia and much of southern Eurasia. In this respect the evidence of the suids from Ad Dabtiyah is most intriguing: clearly, however, better samples are required. In particular, the reports of giant kubanochoeres at Al-Sarrar (Thomas *et al.* 1982) may provide further support for the hypothesis that zoogeographic boundaries shifted northwards during the Middle Miocene.

In conclusion, on the basis of the suids from Ad Dabtiyah, I see no reason to consider the locality as being Lower Miocene in age, unless one either is prepared to re-arrange the upper boundary of the Lower Miocene period to include Mein Zone 4a, or wishes to postulate that the genus *Listriodon* appeared substantially earlier at Ad Dabtiyah than it did in Europe, Africa or Asia.

## Acknowledgements

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